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AMPHINOMIDAE (ANNELIDA: POLYCHAETA) FROM ROCAS ATOLL, NORTHEASTERN BRAZIL [1]

(With 3 figures)

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ABSTRACT: Three amphinomid species from Rocas Atoll - Northeastern Brazil are reported. The re-description of *Eurythoe complanata*, *Hermodice carunculata* and the description of *Linopherus* cf. *canariensis* is provided.

Key words: Amphinomidae. *Eurythoe*. *Hermodice*. *Linopherus*. Rocas Atoll.

RESUMO: Amphinomidae (Annelida: Polychaeta) do Atol das Rocas, nordeste do Brasil.

Três espécies de anfinomídeos do Atol das Rocas, nordeste do Brasil foram identificados. São apresentadas redescrições das espécies: *Eurythoe complanata, Hermodice carunculata* e a descrição de *Linopherus* cf. *canariensis*.

Palavras-chave: Amphinomidae. *Eurythoe*. *Hermodice*. *Linopherus*. Atol das Rocas.

INTRODUCTION

The family Amphinomidae was proposed by Lamarck in 1818. Within this family, 19 genera and 130 species have been recognized (KUDENOV, 1995). The amphinomids are commonly found in shallow tropical and subtropical water; however specimens have also been reported in abyssal depths and polar regions (KUDENOV, 1993).

Members within this family normally have elongated body, more or less sub-rectangular in cross-section, less commonly depressed and sub-elliptic in outline. Colors are nearly always brilliant, often showing shades of green, red, scarlet, violet, or yellow. The prostomium is bilobated and the ventro-lateral palps are located in anterior lobe; it has three antennae, two laterals and a median antenna, present on the anterior and posterior lobes, respectively.

The nuchal organs are ciliary ridges along the caruncle margins, which extends dorsally from the prostomium. Although present in most, some amphinomids lack caruncle.

The parapodia are biramous, with one or two dorsal, and one ventral cirrus. One or two poorly developed pygidial appendages are also present. They possess an eversible pharynx, bearing neither jaws, teeth, nor papillae.

Branchiae may be present on some, or on all notopodia, although they are typically absent on the first setiger. Branchiae shape includes dendritic, bipinate or palmate forms.

All chaetae are calcified, and the notosetae include bifurcate and "harpoon" setae and neurosetae may include curved hooks, bifurcated setae, smooth or spurred spines and capillaries.

Amphinomids together with the other members of the Order Amphinomida are unusual, compared to other polychaetes, in having such features as calcified setae, two pairs of longitudinal nerve cords and a series of ventral epidermal pigment canals that are parallel to the nervous system (GUSTAFSON, 1930). All other known modern polychaetes lack these features, although a few interstitial forms may have two pairs of nerve cords (KUDENOV, 1995).

Diagnostic characters used to identify amphinomids species include the prostomial morphology and the development of prostomial appendages (i.e., eyes and the cacuncle), as well as the distribution of branchiae, setal types, and the distribution of notopodial and neuropodial aciculae (KUDENOV, 1995).

This paper describes the amphinomids species

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collected in Rocas Atoll – Northeastern Brazil, during four expeditions. A re-description of *Eurythoe complanata*, *Hermodice carunculata*, and *Linopherus canariensis* is provided.

MATERIAL AND METHODS:

Specimens were collected at the Rocas Atoll, Northeastern Brazil, 3°51'30"S and 33°49'29"W, on December 2000. This area is characterized by very coarse and calcareous sediment and reefs formation mainly by calcareous algae. Specimens were collected between 2-15m. *Eurythoe complanata* specimens were collected under stones, *Hermodice carunculata* specimens were collected walking on reefs, and *Linopherus canariensis* specimens were collected in coarse and calcareous sediment.

SYSTEMATICS

Family Amphinomidae Lamarck, 1818

Genus *Eurythoe* Kinberg, 1857

Body long, depressed, rectangular in cross section. Prostomium with four eyes. Caruncle elongated. One median and two lateral antennae. Two subulated palps. Parapodia biramous, with projecting rami. Notosetae of three kinds: simple capillary, sub-bifid and serrated. Ventral setae sub-bifid, stout. Each parapodia with a single dorsal and a ventral cirri. Branchiae in tufts of filaments from the second setiger.

Eurythoe complanata (Pallas, 1766)
(Fig.1A-H)

Material examined – 20 specimens. BRAZIL, RIO GRANDE DO NORTE, ROCAS ATOLL, IBUFRJ – 0460, F.Pitombo and R.Barroso coll., XII/2000.

Description – Body 3.7-9.4cm long, 0.5-1.3cm wide, 38-94 setigers. Colorless in alcohol. Prostomium with two pairs of eyes, being the second one more conspicuous. The median antennae aligned to the first pair of eyes, lateral antennae placed anteriorly; palps latero-posteriorly located (Fig.1A). Lips with a transversal groove. Caruncle long, smooth dorsal surface, 6-7 lobes vertically arranged and fixed in the dorsum, extending to the posterior margin of second setiger. Branchiae dendritically branched from setiger 2, with six filaments in setiger two. One dorsal and one ventral cirrus per parapodium. Neurosetae forked with smooth prongs of unequal length (Fig.1B). One specimen presented neurosetae forked with very fine serrations (Fig.1C) (see discussion). Notosetae of four types: forked setae with smooth prongs of unequal length from setiger 1 to 6 (Fig.1D and 1H); harpoon-setae with re-curved serrations on one side from setiger 3 onwards (Fig.1F); smooth pointed setae from setiger 3 onwards (Fig.1E); fine setae with a small spur and a long slender blade from setiger 6 onwards (Fig.1G).

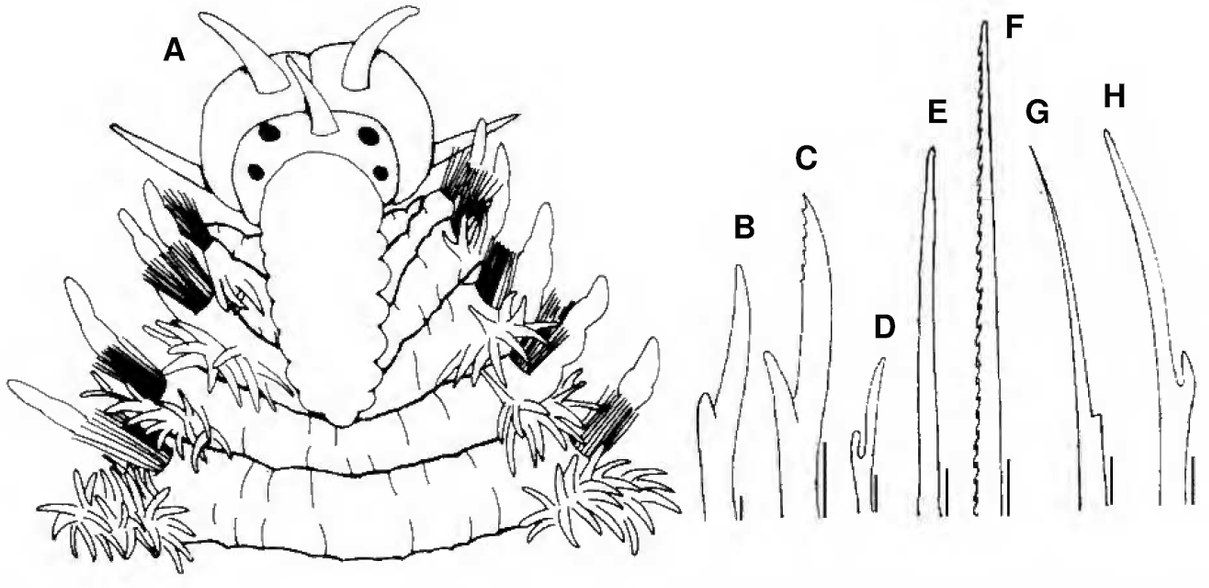

Fig.1- *Eurythoe complanata*: (A) anterior end in dorsal view; (B) furcate neurosetae; (C) furcate neuroetae with fine serrations; (D) and (H) furcate notoetae; (E) smooth pointed notosetae; (F) "harpoon" notosetae; (G) fine "spurred' notosetae. Scale bars = 25µm.

Distribution – From Caribbean Sea to Southern Brazil, including South Atlantic oceanic islands.

Discussion – In the last century, *E. complanata* has been considered synonymous of several others species from the Indian, Pacific and Atlantic Ocean, which increased the wide distribution of this species. Hartman (1948) redescribed and considered synonymous nine species described by Kinberg (1857, 1867) as *Eurythoe complanata*, but maintained *E. capensis* as valid, since the notosetae were serrated and coarser than the neurosetae. *E. capensis* was synonymized as *E. complanata* latter by Day (1951). The circumtropical distribution of this species was suggested by some authors (Núñes, 1991; Amaral & Nonato, 1994; Salazar-Vallejo, 1997), although at least Atlantic and Eastern Pacific lineages are distinct species as demonstrated by Barroso (2005) using allozymes. Some descriptions disagree about the specific details of the forked dorsal and ventral setae, showing diferences in neuropodial setae, as well as the forked setae of the dorsal ramus (Treadwell, 1939:171; McIntosh, 1885, Pl.3A, Fig.9, Núñez, 1991, Fig.2E).

After an examination of specimens from Atlantic, Pacific and Indian Ocean, as well as Mediterranean and Red Sea, Barroso (2005) did not find any difference in morphology among these samples, but a variation of setal morphology of individuals of the same population and among setae from different parapodia. These variations were mainly related to serrations in inner side and proportional length of the longer prong of notopodial sub-bifid setae. This result plus the molecular divergence between Atlantic and Pacific lineages suggests that *E. complanata* is a complex of cryptic species. The fact that this species presents few and simple morphological traits (such as simple setae, pharynx without jaws, teeth or papillae, branchiae in tufts) when compared with others polychaete species, may be responsible for this cosmopolitanism, that can be the result of over conservative systematics (Klautau *et al.*, 1999). Detailed morphological analysis and molecular methods for assessing gene flow are necessary to determine the existence of intraspecific variation and speciation processes among populations and then determine the taxonomic status of this group, including distribution and also the importance of setae morphology, including shape and size in taxonomic studies.

Genus *Hermodice* Kinberg, 1857

Body long, depressed, rectangular in cross section. Prostomium rounded, with four dorsal eyes. Caruncle large, oval, laterally expanded in two foliaceous lobes. One median and two lateral antennae. Two lateral palps arising from buccal lips. Parapodia biramous, projecting. Dorsal setae of two types: smooth capillary and serrate. Ventral setae sub-bifid, denticulate toward rostral extremity. Each parapodia with a single dorsal and a ventral cirrus. Branchiae double, branched, in all parapodia, alternating in position.

Hermodice carunculata (Pallas, 1766)

Material examined – 15 specimens. BRAZIL, RIO GRANDE DO NORTE, ROCAS ATOLL, IBUFRJ – 0461, Collectors: F.Pitombo and R.Barroso coll., XII/2000.

Description – Body 15-24cm long, 1.5cm wide, 75-94 setigers. Prostomium posteriorly surrounded by the first setiger, with two pair of eyes, the second pair seems to be doubled. Median antennae aligned with the first pair of eyes. Buccal lips present a pair of anterior lateral antennae (half length of the median antennae) and a pair of palps latero-posteriorly. Caruncle presents two series of 6 to 9 foliaceous lobes, each series oblique extending backwards to setiger four (Fig.2A). Branchiae dendritically branched, from setiger 1 onwards. One dorsal and one ventral cirrus per parapodium, notopodial cirrus bi-articulated and larger than the neuropodial. Neuropodial setae spurred with serrations (Fig.2B). Notopodial setae smooth and pointed (Fig.2C-D).

Distribution – From Caribbean Sea to Southern Brazil, including Atlantic oceanic islands.

Discussion – *Hermodice carunculata* has a well-documented tropical Atlantic-Mediterranean distribution. In Brazil it has been referred to São Paulo, Rio de Janeiro, Bahia, Pernambuco, and Rio Grande do Norte States. This species is particularly associated with hard substrate, but also has been encountered at or near the surface in flotsam or swimming freely. McIntosh (1885) reported a one foot long specimen swimming.

The specimens from Rocas Atoll showed two color patterns in life, red and purple. No morphological differences were found among individuals of these two color patterns, but the possibility of two species

can not be discharged and a molecular study may be useful to investigate this question. All individuals presented dorsal intersegmental black stripes. Based on this characteristic, BAIRD (1870) described *H. nigrolineata*, rejected by EBBS (1966). HUMANN (1992) considered these stripes as a juvenile character. SALAZAR-VALLEJO (1997) observed small differences between individuals regarding the presence of such black stripes, including sexually mature specimens, pointing out the need for more studies. A comparative study with a high number of specimens of diverse localities is advisable in order to determine if *H. carunculata* is in fact a wide distributed species or a complex of sibling ones.

Genus *Linopherus* Quatrefages, 1865

The genus *Linopherus* was described by QUATREFAGES (1865) based on GRUBE (1860) redescription of *Amphinome incarunculata* Peters, 1854. The validity of this genus has been questioned due to the very superficial description of Quatrefages and an uncertainty on the presence or absence of a caruncle. Peters says: "Diese Art... zeigt keine Spur einer Carunkel" (meaning literally "This type... doesn't show any track of a caruncle"), while Grube mentioned: "caruncle ovalis, margine integro" (AMARAL & NONATO, 1994). The genus *Linopherus*, was not recognized by HARTMAN (1959), which considered *Pseudeurythoe* Fauvel, 1932 as valid. Nevertheless, FAUCHALD (1977), based on the priority principle, considered *Pseudeurythoe* as a junior synonymous of *Linopherus*.

Linopherus is characterized by a prostomium divided transversely with the anterior part bilobed, and bearing a pair of antennae and a pair of palps. The posterior part is almost square, with two pair of eyes and a median antenna. The caruncle is small or absent, sometimes sunk into the first setiger. The parapodia with the notopodia and neuropodia are well separated. A single dorsal cirrus per notopodium. Branchiae are present as single branching tufts, limited to the anterior part of the body. All setae are hollow and brittle, and the notosetae include harpoon-setae and capillaries, while the neurosetae are all spurred.

Linopherus cf. *canariensis* (Langerhans, 1881) (Fig.3A-E)

Material examined – 27 specimens. BRAZIL, RIO GRANDE DO NORTE, ROCAS ATOLL, IBUFRJ – 0459, F.Pitombo and R.Barroso coll., XII/2000.

Description – Body 3.0-9.0mm long ($\overline{X}$ =4.4, S=1.6, N=15), 0.3-0.8 mm wide ($\overline{X}$ =0.4, S=0.1, N=15), 23-48 setigers ($\overline{X}$ =34, S=8.1, N=15). The specimen was colorless in alcohol. Prostomium with anterior and posterior lobes; anterior lobe expanded, rounded and larger than the posterior lobe (Fig.3A-B). Anterior lobe with lateral antennae, slightly bi-articulate, located anteriorly, and a pair of palps slightly bi-articulated located latero-posteriorly. Two pairs of rounded eyes, anterior pair larger. Median antennae smaller than laterals, located between the second pair of eyes.

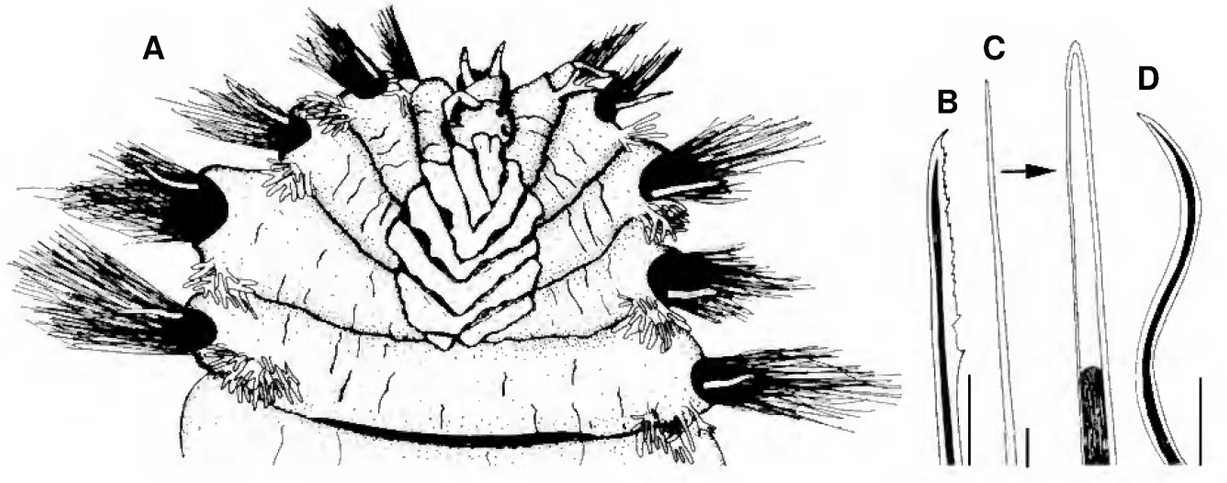

Fig.2- *Hermodice carunculata*: (A) anterior end in dorsal view; (B) "spurred" neurosetae with serrations; (C-D) smooth pointed notosetae. Scale bars = 100μm.

No caruncule. Parapodia biramous with notopodial and neuropodial cirri; notopodial cirri of the same length throughout the body. Branchiae present in setigers 3-7 (in some individuals ending in setigers 6 or 8). Each branchia with 3-6 filaments. Neurosetae spurred in two sizes, longer with a spur at the base of a serrated blade (Fig.3D), smaller with a well marked spur and coarser serrations on the longer prong (Fig.3C). Notosetae slender, smooth, ribbon-shape (Fig.3E). Some individuals with well-developed pygidial appendages.

Variation – The articulations of the lateral paired antennae and palps were not observed in all individuals, probably due to their small size or due to intraspecific variation. We think that this character (articulations of antennae and palps) does not help to sort out species.

Discussion – Specimens studied are quite similar to the description of *Linopherus canariensis* (Langerhans, 1881) presented by Núñes *et al.* (1991) based upon specimens from Canary Islands (type locality), but some differences were observed between specimens from Canary Island and Rocas Atoll. Differences were related to the number of branchial filaments on the first branchial setiger (one filament in Canary Islands individuals and 3-5 in Rocas Atoll individuals) and the occlusion of the second pair of eyes by the first setiger in Canary individuals, while in Rocas Atoll specimens the second pair of eyes is visible. These differences could be easily regarded as phenotypic plasticity or fixation artifacts. Furthermore, number of branchial filaments is a character likely to vary during ontogeny. *L. canariensis* was already reported from Canary Islands, Panama, Mexico, and Cuba. This species lives in interstices of organic sediments on tropical region of Atlantic Ocean.

Up to now, there are two species of *Linopherus* referred to Brazil: *L. canariensis* and *L. ambigua* (Monro, 1933) referred by Amaral & Nonato (1994). Even though it is likely that a complex of species would be covered under this name since it had been considered as a cosmopolitan species, referred to Pacific, Indian, and Atlantic Oceans. These two species differs each other mainly by presence of branchiae restricted to setigers 3 to 7 and body length of 2-9mm in *L. canariensis*, while *L. ambigua* possess branchiae from setiger 3 to 43 and body length of 47mm.

A key including the species of *Linopherus* was presented by Fauchald (1972) and modified by Salazar-Vallejo (1987), who considered as valid 17 species.

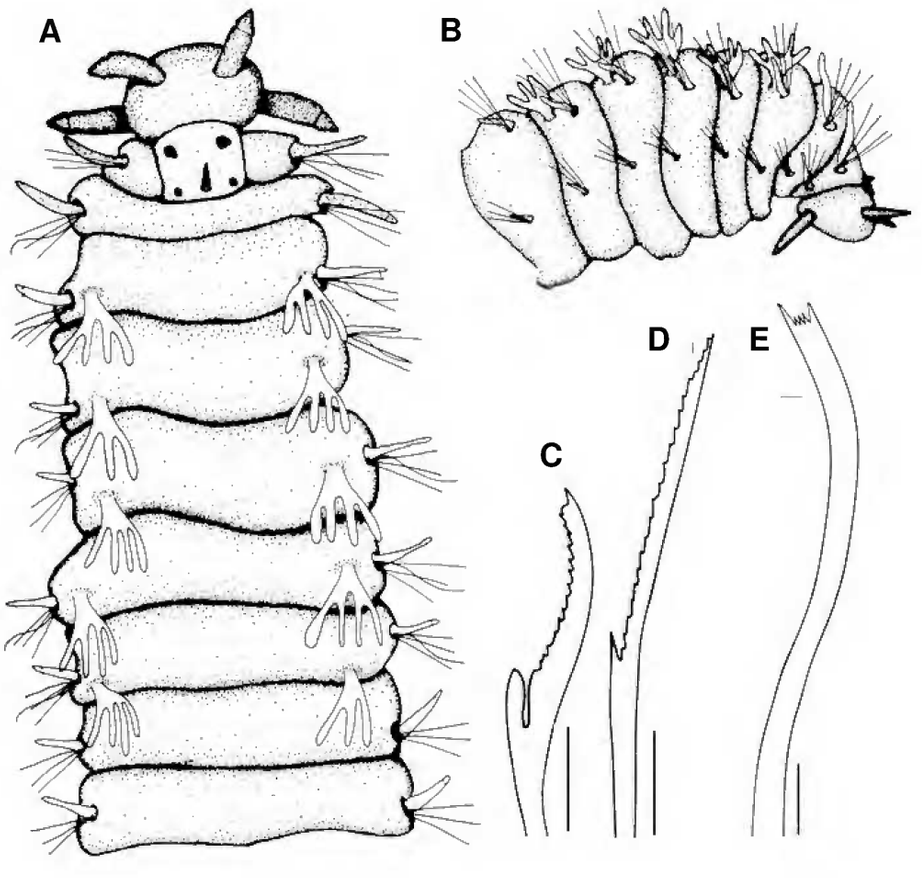

Fig.3- *Linopherus* cf. *canariensis*: (A) anterior end in dorsal view; (B) anterior end in lateral view; (C-D), forked denticulated neurosetae of two types; (E) slender and smooth notosetae. Scale bars = 50μm.

The species of *Linopherus* have been distinguished mainly by the number of branchial setigers, number of terminal branchial filaments, presence and number of eyes, relative length of notopodial and neuropodial cirri of first and second setiger, caruncle (present or absent), and few setal characters, that has been poorly described. Which one of these characters are in fact synapomorphies for this group it is still unknown.

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